

**OROVILLE FERC RELICENSING
(PROJECT NO. 2100)**

**DRAFT REPORT
SP-F3.2, Task 1
SP-F21, Task 2**

**FISH DISTRIBUTION IN THE FEATHER RIVER BELOW THE
THERMALITO DIVERSION DAM TO THE CONFLUENCE WITH THE
SACRAMENTO RIVER**

REVIEW DRAFT

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1.0 SUMMARY

Operations of the Oroville Facilities have the ability to affect the quality, quantity and distribution of fish habitat and, therefore, have the potential to affect the distribution of several fish species in the Feather River. Developing an understanding of the distribution of the fish in the Feather River is the first step in a process designed to evaluate potential relationships between the operations of the Oroville Facilities and fisheries resources. The purpose of this draft report is to establish an informational baseline describing the current knowledge of fish distribution in the Feather River. The fish distribution information will continue to be refined as additional information becomes available from the ongoing relicensing project studies.

This deliverable satisfies the requirement to develop and describe fish distribution information in the Feather River, as defined in study plans SP-F3.2 and SP-F21. In order to ensure consistency in the characterization of each fish species, and in order to avoid inefficiencies in the development of these similar deliverables, a series of fifteen fish distribution maps encompassing the fish distribution characterization requirements from these study plans were completed and described in this draft report. Conclusions from the fish distribution information will be developed and presented as work products are completed from the study plan tasks that this deliverable was designed to support.

2.0 PURPOSE

The purpose of this draft report on fish distribution is to establish an informational baseline describing the current knowledge of fish distribution in the Feather River. Section 4.51(f)(3) of 18 CFR requires reporting of certain types of information in the Federal Energy Regulatory Commission (FERC) application for license of major hydropower projects, including a discussion of the fish, wildlife, and botanical resources in the vicinity of the project (Code of Federal Regulations 2001). The discussion is required to identify the potential impacts of the project on these resources, including a description of any anticipated continuing impact for on-going and future operations. As subtasks of SP-F3.2 and SP-F21, both of these tasks fulfill a portion of the FERC application requirements by detailing the distribution of fish species of special regulatory status, and fish species of primary management concern. In addition to fulfilling these requirements, information developed in this task may be used in developing or evaluating potential protection, mitigation, and enhancement (PM&E) measures.

Several fish species considered under Task 1 of SP-F3.2 and Task 2 of SP-F21 are species of special regulatory status, meaning that they are federally or state-listed threatened or endangered species under the Endangered Species Act (ESA), species which are candidates for listing under the ESA, or species which are California species of special concern. Species with special regulatory status considered under SP-F3.2 include Sacramento splittail (*Pogonichthys macrolepidotus*), green sturgeon (*Acipenser medirostris*), and river lamprey (*Lamptera ayresi*), while species with special regulatory status considered under SP-F21 include steelhead (*Oncorhynchus mykiss*), spring-run Chinook salmon (*Oncorhynchus tshawytscha*), and fall-run Chinook salmon (*Oncorhynchus tshawytscha*). The regulatory status of each of these species is described below.

On February 8, 1999, Sacramento splittail was designated as Threatened under the ESA by the U.S. Fish and Wildlife Services (USFWS) (USFWS 1999). Splittail were listed as Threatened throughout their entire range, which includes the Feather River (USFWS 1999).

On June 12, 2001, the National Marine Fisheries Service (NMFS) received a petition from the Environmental Protection Information Center, Center for Biological Diversity, and Waterkeepers Northern California regarding the North American green sturgeon, in which the petitioners requested that NMFS list this species as either an endangered or threatened species under the ESA (Environmental Protection Information Center et al. 2001). On December 14, 2001, NMFS announced a 90-day finding that the petition presents substantial scientific and commercial information indicating that listing the North American green sturgeon may be warranted (NMFS 2001). While acceptance of the petition does not mean that listing is a given outcome, acceptance of the petition under the ESA requires that NMFS promptly commence a status review for the species concerned and make a finding as to whether the petitioned action is warranted within 12 months of the receipt date of the petition (NMFS 2002).

In June of 1995, river lamprey was designated as a California Species of Special Concern by the California Department of Fish and Game (DFG) (Moyle et al. 1995). "Species of Special Concern" (SSC) status applies to animals not listed under the federal Endangered Species Act (ESA) or the California Endangered Species Act, but which nonetheless: 1) are declining at a rate that could result in listing; or 2) historically occurred in low numbers and known threats to their persistence currently exist (DFG 2002). As described by DFG, "...*this designation is intended to result in special consideration for these animals by the Department, land managers, consulting biologists, and others, and is intended to focus attention on the species to help avert the need for costly listing under federal and State endangered species laws and cumbersome recovery efforts that might ultimately be required. This designation also is intended to stimulate collection of additional information on the biology, distribution, and status of poorly known at-risk species, and focus research and management attention on them...*" (DFG 2002). Species of Special Concern are categorized into one of 4 classes: Class 1 - Endangered or Threatened; Class 2 - Special Concern; Class 3 - Watch List; and Class 4 - Secure. River lamprey are listed as a Class 3 Watch List species, meaning that they occupy much of their native range, but were formerly more widespread or abundant within that range (Moyle et al. 1995).

On March 19, 1998, naturally-spawned Central Valley steelhead (*Oncorhynchus mykiss*) were listed as Threatened under the federal ESA by NMFS (NMFS 1998). The Central Valley steelhead Evolutionarily Significant Unit (ESU) includes all naturally-spawned populations of steelhead (and their progeny) in the Sacramento and San Joaquin Rivers and their tributaries, which includes the naturally-spawned steelhead in the Feather River (NMFS 1998).

On September 19, 1999, naturally-spawned Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) were listed as Threatened under the federal ESA by NMFS (NMFS 1999). The Central Valley spring-run Chinook salmon ESU includes all naturally-spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, which includes the naturally-spawned spring-run Chinook salmon in the Feather

River (NMFS 1999). In the same ruling, NMFS determined that naturally-spawned Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*) were not warranted for listing under the federal ESA (NMFS 1999). However, the Central Valley fall-run Chinook salmon ESU was designated as a candidate for listing (NMFS 1999). The Central Valley fall-run Chinook salmon ESU includes all naturally-spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries, which includes naturally-spawned fall-run Chinook salmon in the Feather River (NMFS 1999).

In addition to species with special regulatory status, information regarding the distribution of fish of primary management concern (SP-F3.2) and predator and prey species of primary management concern (SP-F21) also was collected and compiled into fish distribution maps. As described in SP-F3.2, Task 1, non-salmonid fish of primary management concern include members of the *Centrarchidae* family (including black bass and sunfish), striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), hardhead (*Mylopharodon conocephalus*), hitch (*Lavinia exilicauda*), Pacific lamprey (*Lamptera tridentata*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento sucker (*Catostomus occidentalis*), tule perch (*Hysterocarpus traski*), and white sturgeon (*Acipenser transmontanus*) (Department of Water Resources (DWR) 2002d). As described in SP-F21, Task 2, prey species of primary management concern in the Feather River are juvenile anadromous salmonids, including juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and juvenile steelhead (*Oncorhynchus mykiss*), and predator species of primary management concern include Sacramento pikeminnow and striped bass (DWR 2002c).

Distributions in the Feather River of the fish species described in SP-F21 (Task 2) and SP-F3.2 (Task 1) have the potential to be affected by operations of the Oroville Facilities. Evaluations of potential relationships between operations of the Oroville Facilities and the quality, quantity, and distribution of fish and their habitats in the Feather River requires, in part, current baseline information on fish distribution. The purpose of this draft report is to establish an informational baseline describing the current knowledge of fish distribution in the Feather River.

This draft report satisfies the requirements defined in Task 1 of SP-F3.2 and Task 2 of SP-F21 for documentation of fish distribution in the Feather River from the Thermalito Diversion Dam to the confluence with the Sacramento River (DWR 2002c; DWR 2002d). Information regarding fish distribution in the Feather River was collected from a variety of sources, as described in the "Background" and "Methodology" sections of this report. The distribution of fish species was represented using maps delineating the geographic distribution of each species or class of species. As appropriate, temporal distributions of fish species were described using lifestage pinwheel diagrams (for additional description, see "Methodology").

The fish distribution maps and lifestage pinwheel diagrams are generalized to those geographic and temporal distributions that are considered "typical," accounting for seasonal, annual, and water year-type variations. For example, Sacramento splittail distribution is sporadic, and splittail use of the Feather River varies from year-to-year (Sommer et al. 1997). As a result, maps describing the geographic and temporal distribution of splittail represent generalizations of both annual and seasonal variability. The distribution maps and lifestage pinwheels represent a "typical" scenario describing the most commonly documented

temporal and geographic fish distributional trends. However, it is possible that in some years, temporal and geographic fish distribution may fall outside of the boundaries described in this draft report.

Assimilation of the existing fish distribution information has the potential to affect the design and implementation of future fisheries studies and field data collection efforts. As this fish distribution information is finalized utilizing information from ongoing FERC relicensing studies, fish distribution information will be compared to the location and distribution of fish habitat requirements by species, as described in Task 5 of SP-F3.2. This comparison will contribute to the evaluation of Oroville Facilities operations potential effects on fish habitat availability, suitability, and utilization, and species interactions. Additionally, the information developed in this task may support the development or evaluation of potential protection, mitigation, and enhancement (PM&E) measures.

3.0 BACKGROUND

Because this deliverable is a compilation of the requirements for characterizing the distribution of fish species for both SP-F3.2 and SP-F21, the geographic area represented by this deliverable is defined by the aggregation of the geographic scopes of both of these study plans. The resulting geographic scope represented by this deliverable encompasses the Feather River from the Thermalito Diversion Dam to the confluence with the Sacramento River.

In order to describe the distribution of fish in the Feather River, information from a variety of sources, including snorkel surveys, beach seine surveys, rotary screw trap surveys, and creel surveys, was collected and compiled. The fish distribution maps were based on snorkel survey data, beach seine data, and rotary screw trap data, as well as the Feather River field experience and professional judgment of DWR fisheries staff biologists. The survey programs that provided this data are briefly described below. Creel survey data from DFG were not utilized in the development of these fish distribution maps due to recently discovered concerns associated with the 1998-2000 creel survey reports (pers. com., T. Schroyer, DFG, 2002). The previously published reports and the 2001 creel survey results will be corrected and published within a few months, and DFG is currently evaluating whether they will continue their creel census on the Feather River into 2003 (pers. com., T. Schroyer, DFG, 2002). Upon release of the revised creel data from DFG, creel data will be examined to determine if there is any additional information to be incorporated into the draft fish distribution maps.

Several recent surveying programs have provided data regarding the distribution of fish species in the Feather River (see “Feather River Fish Distribution - Data Source Locations, Map 1”). An extensive snorkel survey program, which provides information about distribution of a variety of fish species, has been conducted annually beginning in 1999 (DWR 2002e). Three types of snorkel surveys are conducted each year, with each type having slightly different objectives. The broad-scale snorkel survey is conducted once annually, in early summer, and provides a “snapshot” of the overall distribution of fish in the Feather River downstream of the Fish Barrier Dam. This survey is conducted from the Fish Barrier Dam to Gridley Bridge, and takes approximately two weeks to complete. The

intermediate-scale survey occurs once a month, from March through August, at nine permanent snorkeling sites. Six of the snorkeling sites are located between the Fish Barrier Dam and the Thermalito Afterbay Outlet, while the remaining three sites are located between the Thermalito Afterbay Outlet and the confluence with Honcut Creek. Intermediate-scale snorkel surveys provide information regarding both the temporal and geographic distribution of a variety of fish species in the Feather River. Fine-scale snorkel surveys began in 2001, and occur monthly from March through August. These surveys are designed to collect information regarding fish distribution and habitat utilization data within habitat small units (25 by 4-meter transects) (DWR 2002e). Although snorkeling can provide important data, quantitative application of snorkel data may be limited because of special considerations when observation conditions are less than ideal. For example, in waters with dark substrate, benthic fishes and other benthic organisms may be difficult to observe by snorkeling. Snorkelers may fail to detect or incorrectly identify target organisms, count them more than once, or inaccurately estimate size. Counting organisms accurately in a dense population can be difficult. Some species and sizes of fish are more difficult to see than others, especially species that remain near the substrate or concealed by cover. Differences in fish behavior during times of the day or year also may influence observability. In large rivers, multiple divers are needed to estimate populations, which increases observer bias (Dolloff et al. 1996).

In addition to snorkel surveys, seine surveys have been conducted 1997 – 2001 to document fish distribution (DWR 2002a). 16 permanent seining stations located between the Fish Barrier Dam and Boyd's Pump (two miles downstream of Shanghai Bend) were sampled monthly, and as time allowed, sampling was conducted at any of the 24 alternative seining sites (DWR 2002a). Box seining was conducted at boat ramps, while sweeping beach seining was used in open and moving water habitats (DWR 2002a). Because seining was conducted on a monthly time-step and at multiple locations, it provides information regarding both the temporal and geographic distribution of fish species (DWR 2002a). Seining results for the Feather River provide a partial view of local fish assemblages. Seining is limited to shallow water with a fairly uniform bottom, to prevent snags or rock entrapment that may injure or kill fish. Low water velocities also are needed so the net does not invert during deployment. As a consequence, sampling overlooks fish in deep-watered, rough-bottomed or swift habitats. In addition, seining can miss fish that out-manuever the net. Seining appears ineffective in sampling lamprey and centrarchids, especially largemouth bass (DWR 2002a).

Beginning in 1996, rotary screw traps (RSTs) have operated at two locations, just upstream of the Thermalito Afterbay Outlet (RM 59.8) and near Live Oak (RM 42) (DWR 2002b). RSTs are continuous sampling devices that sample fast-moving water habitats. Generally, the RSTs are operated each year from mid-November through June (DWR 2002b). The RSTs are primarily designed for estimating the number of emigrant juvenile salmonids, including Chinook salmon and steelhead, but other species also are caught in the RSTs (DWR 2002b). Chinook salmon are the dominant species caught in the RSTs, comprising over 99 percent of the catch. Very few yearling steelhead have been caught in the RSTs, probably because of the ability of larger fish to avoid capture, and their lack of movement. Data from RSTs primarily serve to provide information regarding the temporal and geographic distribution of juvenile salmonids and the environmental factors that influence juvenile emigration timing (DWR 2002b). RST capture efficiencies can be affected by several biotic and abiotic factors, including the size distribution of fish and water velocities.

For example, the Live Oak RST has been ineffective at catching larger fish at low flows (1,000-1,500 cfs) (DWR 2002b).

DFG has collected creel survey data on the Feather River from 1998 through 2001. The creel survey is collected and aggregated for reporting based on census areas that generalize the fish distribution information. The survey indicates a count of the documented fish caught for each month by species, by geographic census area, along with additional information (e.g., fish length and sex). There are only two creel census geographic areas for the Feather River, so the representation of the distribution of the fish species is significantly generalized compared to the snorkel survey or seining fish distribution data sets. Upon release of the updated creel data from DFG, creel data will be examined to determine if there is any additional information to be incorporated into the draft fish distribution maps.

DWR is collecting creel survey data for the relicensing project, which started in June 2002 and will continue through June 2003 (SP-R13). The Feather River is represented by two survey areas. Creel survey results will be reported in June of 2003. The upstream survey area covers the Feather River from the Thermalito Diversion Dam downstream to the crossing of Highway 162 (survey area 12), and the other survey area covers the Feather River from the Highway 162 crossing to the downstream extent of the Oroville Wildlife Area (OWA) (survey area 11). The OWA and Feather River fish catches are not differentiated for the survey. The survey documents the number of species and size of fish caught for each survey area. Given the generalization of the documentation of fish catches of the creel survey into two geographic areas for the Feather River, the creel survey data may not significantly enhance the resolution of the geographic definition of fish distributions when this data is integrated into the fish distribution maps. Creel survey information, however, will provide opportunities for refinement of the current understanding of temporal distributions and species interactions in the Feather River.

The information from snorkel surveys, beach seining surveys, RST sampling, and field observations by DWR fisheries biologists was integrated to produce fish distribution maps describing the most commonly documented temporal and geographic fish distributional trends, as described in the "Purpose" section of this report.

4.0 METHODOLOGY

The objective of this task was to document the distribution of non-salmonid and primary predator and prey fish species observed in the Feather River from the Thermalito Diversion Dam to the confluence with the Sacramento River (DWR 2002d). Fish distribution information was compiled from a variety of sources, and was mapped for the following fish species or guild of species, as specified in SP-F3.2 and SP-F21 (DWR 2002c; DWR 2002d):

- Sacramento splittail (*Pogonichthys macrolepidotus*)
- green sturgeon (*Acipenser medirostris*) and white sturgeon (*Acipenser transmontanus*)
- Central Valley adult steelhead (*Oncorhynchus mykiss*)
- Central Valley juvenile steelhead (*Oncorhynchus mykiss*)

- Central Valley juvenile spring-run and juvenile fall-run Chinook salmon (*Oncorhynchus tshawytscha*)
- *Centrarchidae* family, including spotted bass (*Micropterus punctulatus*), largemouth bass (*M. salmoides*), smallmouth bass (*M. dolomieu*), red-eye bass (*M. coosae*), bluegill (*Lepomis macrochirus*), green sunfish (*L. cyanellus*), redear sunfish (*L. microlophus*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*P. annularis*)
- hardhead (*Mylopharodon conocephalus*) and Sacramento pikeminnow (*Ptychocheilus grandis*)
- striped bass (*Morone saxatilis*)
- American shad (*Alosa sapidissima*)
- hitch (*Lavinia exilicauda*)
- Pacific lamprey (*Lamptera tridentata*)
- river lamprey (*Lamptera ayresi*)
- Sacramento sucker (*Catostomus occidentalis*)
- tule perch (*Hysterocarpus traski*)

Fish species listed together, above, are mapped on one distribution map. Aggregations of multiple species on a single map composition were developed to simplify and condense information and documentation when fish data on relative abundance, distribution and periodicity were compatible.

Specific information targeted to be summarized included:

- Temporal and geographic distribution of fish by species;
- Characterization of the relative abundance of fish including, as available, seasonal and geographic variations in relative abundance; and
- Characterization of interannual variability in geographic distribution of fish.

Geographic distributions of the fish are represented by the highlighted portions of the river reaches on the accompanying maps (see “Geographic Distribution” and Appendix A, Maps 1 through 15). Relative abundance of fish is represented on the maps by a color code classification of “Frequently Observed” and “Infrequently Observed” by river reach (see “Relative Abundance,” below). Seasonal variability of the relative abundance and distribution is represented by classifications of abundance by geographic area by season (see “Geographic Distribution” and specific explanations in Sections 5.13 and 5.15 below). Interannual variability in the geographic distribution of fish is explained in “Geographic Distribution” and the narratives in Sections 5.2, 5.3, and 5.7, below. Temporal distribution of the fish is represented by the lifecycle pinwheel diagrams found on those maps representing seasonal migratory fish (see “Seasonal Distribution,” below.)

4.1 GEOGRAPHIC DISTRIBUTION

The geographic distribution of the fish, represented on the fish distribution maps (Appendix A) by color highlighted river reaches, is representative of the “typical distribution” as generalized from the fish distribution data sources and based on the professional judgment and Feather River field experience of the DWR Fisheries Biology staff. Maps represent the typical distribution of fish by species, accounting for generalizations of distribution on a

seasonal, interannual, or water year-type where sufficient quantity, quality, or resolution of data is not currently available to support more definitive distribution characterizations.

4.2 RELATIVE ABUNDANCE

Of the four data sources utilized to develop the fish distribution maps (Appendix A), only rotary screw traps provide estimates of fish abundance, and these abundance estimates are limited to emigrating juvenile Chinook salmon. Because the rest of the data sets relied upon for the development of these fish distribution maps are based on observations of presence, and each data source has specific potential biases in the type and quality of data (see “Background,” above), the fish distribution maps represent “relative” abundance of fish based on the number or frequency of observations. The fish distribution sampling effort is not evenly distributed geographically or temporally, which also potentially biases resultant distribution. Because of the unquantifiable qualitative differences in the data collected by each fish distribution sampling method (see “Background”), it is not feasible to normalize the fish distribution data. Therefore, fish distribution relative abundance is presented as “Frequently Observed” and “Infrequently Observed.”

Relative abundance of “Frequently Observed” or “Infrequently Observed” is relative only within a specific species. Relative abundance does not apply across species (e.g., “Frequently Observed” for hitch does not mean that the number of hitch is of the same order of magnitude as “Frequently Observed” Chinook salmon). The designation of “Frequently Observed” is used to characterize those areas in which a specific fish species is most commonly observed in the greatest numbers. “Infrequently Observed” are those areas in which a specific fish species is typically observed less frequently, less consistently, or in lower numbers than in those areas designated “Frequently Observed.”

Those fish represented in the fish distribution maps as “Infrequently Observed” in the Fish Barrier Pool (see “Results,” Sections 5.5, 5.8, 5.12, and 5.14) are based on DWR Fisheries Biologist staff professional opinion and their local knowledge of upstream fish composition, and anecdotal reports of fish catches. Creel surveys conducted by DFG and DWR cover this geographic area, but the Fish Barrier Pool is not differentiated in the documentation from the rest of the upper portion of the river reach below the Fish Barrier Dam. No other types of fish surveys have been conducted (nor are any surveys planned for the relicensing project) in the Fish Barrier Pool. Fish present in the Fish Barrier Pool would be either self-sustaining populations, or are recruited from the fish populations in the diversion pool and Thermalito Afterbay. The Fish Barrier Dam is a barrier to fish upstream migration from the lower Feather River, so the extrapolation of the upstream fish composition to the Fish Barrier Pool is the most reasonable representation of the current level of knowledge. Based on this logical extrapolation of the fish distribution information, the representation of “Infrequently Observed” is therefore not quantified even to the same relative degree as the other representations of fish distribution.

4.3 SEASONAL DISTRIBUTION

Some fish are resident in the Feather River year-round, while others are migratory fish that are present in the Feather River seasonally. Migratory fish are represented with a “fish lifecycle calendar” (see **Figure 1** below). The fish lifecycle calendar represents the temporal

distribution of each fish lifestage. These representations are generalizations based on the best available information. In some cases, these are well documented and are based on Feather River specific observations. In other cases, the information represented is based on general published literature that may be based on observations from other river systems. Not all lifestages are represented, as in some cases insufficient data is available to define the temporal ranges of specific lifestages.



Figure 1. Example of migratory fish lifecycle calendar.

Months are represented on the outermost ring of the calendar, and the timing and duration of lifestages are represented by successive rings of information on the inside rings. Periods of time representing peak level of activity for a lifestage are represented in solid colors, while those periods of time representing less intensive activity (“off peak”) for a lifestage are represented by the same color with a hatched pattern. Periods of “Feather River Residency” are represented by a gray ring at the innermost location on the lifecycle calendar on the maps for those fish that are migratory. Periods of “Adult In-Ocean Residence” (representing full, and usually multiple, years) are labeled and color coded blue. Periods of “Adult Immigration” are represented in yellow. “Spawning” periods are represented in pink. “Incubation and Initial Rearing” are represented in orange and “Juvenile Rearing” is represented in light blue. As mentioned previously, not all lifestages listed here are available for all fish due to their applicability to the fish or the availability of the information.

4.4 FISH DEPICTIONS

Representative pictures of the typical appearance of the fish on each of the maps (except for Map 5 due to space constraints) are included in the map compositions to provide a visual depiction of the fish species and its morphological characteristics.

5.0 RESULTS

5.1 DATA SOURCES

The location and distribution of the sampling sites that were utilized in the development of the fish distribution maps to satisfy the requirements of both SP-F3.2 Task 1 and SP-F21 Task 2 are presented in Appendix A, Map 1. Data sources included rotary screw traps (RSTs), snorkel surveys (both intermediate- and broad-scale) and beach seining (see “Background” for a description of each data source). The upper portions of the Feather River are more intensively sampled than the lower portions of the river; therefore, the resolution of the fish distribution data is greater in upstream areas where more sampling has been conducted. River mile locations for beach seining sample sites are included on the map.

5.2 GREEN STURGEON AND WHITE STURGEON

White sturgeon are more commonly observed in the Feather River than green sturgeon. Sturgeon are infrequently observed from the Thermalito Afterbay Outlet to the confluence of the Sacramento River. Distribution information will be augmented by radio tracking, scuba surveys, and creel surveys that will be conducted in the 2003 season. Sturgeon are resident year-round and, therefore, all lifestages are present in the Feather River. Detailed information on the distribution of sturgeon is presented in Appendix A, Map 2.

5.3 SACRAMENTO SPLITTAIL

Sacramento splittail distribution is sporadic, and splittail use of the Feather River varies from year-to-year (Sommer et al. 1997). They are infrequently observed in the Feather River from the confluence with Honcut Creek to the confluence with the Sacramento River. Splittail are present in the Feather River during spawning, which generally extends from January through April, with peak spawning occurring in February and March. Detailed information on the distribution of splittail is presented in Appendix A, Map 3.

5.4 RIVER LAMPREY

River lamprey are less commonly observed in the Feather River than Pacific lamprey. River lamprey are infrequently observed in the Feather River from the Fish Barrier Dam to the confluence with the Sacramento River. Adults have been observed spawning in riffles near Honcut Creek. Juveniles rear in the river year-round (pers. com., B. Cavallo, DWR, 2002). Detailed information on the distribution of river lamprey is presented in Appendix A, Map 4.

5.5 CENTRARCHIDS

Largemouth bass are the most numerous of the black bass species, and bluegill are the most numerous of the sunfish species observed in the Feather River. All centrarchid fishes are frequently observed from the Thermalito Afterbay Outlet to the confluence with the Sacramento River, and are infrequently observed from Steep Riffle to the Thermalito Afterbay Outlet. Centrarchid fishes are believed to be present in relatively low numbers in the Fish Barrier Pool (pers. com., B. Cavallo, DWR, 2002). Centrarchids are resident year-

round and, therefore, all lifestages are present in the Feather River. Detailed information on the distribution of centrarchids is presented in Appendix A, Map 5.

5.6 STRIPED BASS

Striped bass are an important seasonal sport fish in the Feather River. Striped bass are frequently observed from the Thermalito Afterbay Outlet to the confluence with the Sacramento River, and are infrequently observed from Steep Riffle to the Thermalito Afterbay Outlet. Striped bass are present in the Feather River during adult immigration and spawning, which generally extends from April through June, with peak spawning occurring in May. Detailed information on the distribution of striped bass is presented in Appendix A, Map 6.

5.7 AMERICAN SHAD

Shad are an important seasonal sport fish in the Feather River. American shad are frequently observed in the Feather River from the Thermalito Afterbay Outlet to the confluence with the Sacramento River, and are infrequently observed from Steep Riffle to the Thermalito Afterbay Outlet. American shad are present in the Feather River from May through mid-December, during the adult immigration, spawning, and juvenile emigration periods of their lifecycle. Adult immigration occurs in May and June, spawning occurs in June and July, and juvenile emigration occurs from July through mid-December. Detailed information on the distribution of American shad is presented in Appendix A, Map 7.

5.8 SACRAMENTO PIKEMINNOW AND HARDHEAD

Pikeminnow are the more commonly observed of these two species. These fish are one of the most frequently observed on the Feather River, with the exception of the more numerous salmonids (pers. com., B. Cavallo, DWR, 2002). Pikeminnow are frequently observed in the Feather River from the Fish Barrier Dam to the confluence with the Sacramento River, and are infrequently observed in the Fish Barrier Pool (pers. com., B. Cavallo, DWR, 2002). Pikeminnow and hardhead are resident year-round and, therefore, all lifestages are present in the Feather River. Detailed information on the distribution of Sacramento pikeminnow and hardhead is presented in Appendix A, Map 8.

5.9 PACIFIC LAMPREY

Pacific Lamprey are more commonly observed than river lamprey. Pacific lamprey are frequently observed in the Feather River from the Fish Barrier Dam to the confluence with the Sacramento River. They are present in the Feather River from April through July, during the adult immigration and spawning periods of their lifecycle. Adult immigration occurs from April through July, and spawning occurs from May to July. Detailed information on the distribution of Pacific lamprey is presented in Appendix A, Map 9.

5.10 HITCH

Hitch are frequently observed in the Feather River from the Thermalito Afterbay Outlet to the confluence with the Sacramento River. Hitch are resident year-round and, therefore, all

lifestages are present in the Feather River. Detailed information on the distribution of hitch is presented in Appendix A, Map 10.

5.11 TULE PERCH

Tule perch are frequently observed in the Feather River from the Thermalito Afterbay Outlet to the confluence with the Sacramento River, and are infrequently observed from the Fish Barrier Dam to the Thermalito Afterbay Outlet. Tule perch are resident year-round and, therefore, all lifestages are present in the Feather River. Detailed information on the distribution of tule perch is presented in Appendix A, Map 11.

5.12 SACRAMENTO SUCKER

Sacramento suckers are frequently observed in the Feather River from the Fish Barrier Dam to the confluence with the Sacramento River, and infrequently observed in the Fish Barrier Pool (pers. com., B. Cavallo, DWR, 2002). Sacramento suckers are resident year-round and, therefore, all lifestages are present in the Feather River. Detailed information on the distribution of Sacramento sucker is presented in Appendix A, Map 12.

5.13 JUVENILE CHINOOK SALMON

Juvenile Chinook salmon are the most numerous observed fish in the Feather River (pers. com., B. Cavallo, DWR, 2002). Chinook salmon are present in the Feather River year-round, during the spring- and fall-run adult immigration, spawning, and juvenile rearing and emigration periods of their lifecycles. Juvenile Chinook salmon are frequently observed in the Feather River from December through June, from the Fish Barrier Dam to the confluence with the Sacramento River. They are infrequently observed from July through November from the Fish Barrier Dam to the Thermalito Afterbay Outlet. Detailed information on the distribution of juvenile Chinook salmon is presented in Appendix A, Map 13. Distributional information presented on Appendix A, Map 13 pertains only to juvenile Chinook salmon, whereas the fish lifecycle calendar provides information for all Chinook salmon lifecycle periods.

5.14 JUVENILE RAINBOW TROUT/STEELHEAD

Rainbow trout and steelhead are the same species of fish, but are differentiated by differences in life history behavior. Steelhead have an ocean residence lifecycle phase, whereas rainbow trout spend their entire lifecycle as freshwater residents. Juvenile rainbow trout and juvenile steelhead are frequently observed in the Feather River from the Fish Barrier Dam to the Thermalito Afterbay Outlet, and are infrequently observed from the Thermalito Afterbay Outlet to Gridley Bridge. They are also infrequently observed in the Fish Barrier Pool (pers. com., B. Cavallo, DWR, 2002). Rainbow trout are resident year-round and, therefore, all lifestages are present in the Feather River. Juvenile steelhead also are present year-round in the Feather River. Detailed information on the distribution of juvenile rainbow trout/steelhead is presented in Appendix A, Map 14. Distributional information presented on Appendix A, Map 14 pertains only to juvenile rainbow trout and steelhead, whereas the fish lifecycle calendar provides information for all lifecycle periods.

5.15 ADULT RAINBOW TROUT/STEELHEAD

Adult rainbow trout and adult steelhead are frequently observed in the Feather River from the Thermalito Afterbay Outlet to the confluence with Honcut Creek during the spring and fall, and are frequently observed from the Fish Barrier Dam to the Thermalito Afterbay Outlet during the spring, summer, and fall. They also are infrequently observed in the Fish Barrier Pool (pers. com., B. Cavallo, DWR, 2002). Distribution representation in the Fish Barrier Pool is based on the likely recruitment of rainbow trout from the Forebay stocking program. Adult rainbow trout are resident year-round, whereas adult steelhead exhibit an anadromous lifecycle. Adult steelhead immigration occurs from September through March, and spawning occurs from December through April. Detailed information on the distribution of adult rainbow trout/steelhead is presented in Appendix A, Map 15. Distributional information presented on Appendix A, Map 15 pertains only to adult rainbow trout and steelhead, whereas the fish lifecycle calendar provides information for all rainbow trout/steelhead lifecycle periods.

6.0 CONCLUSIONS

Geographic and temporal data resolution, as well as seasonal and annual variations in environmental factors potentially resulting in variability in fish distribution, limit the definitive utilization of the fish distribution data. Nonetheless, the fish distribution data and maps, particularly for the more frequently observed species/lifestage (i.e., juvenile Chinook salmon), provide baseline information to be used in a general approach to establish profiles or comparisons of fish distribution versus habitat conditions.

Additional information from fish surveys will continue to develop and refine the fish distribution information. Surveys planned for the 2003 field season include adult spring-run Chinook salmon and sturgeon radio tracking, scuba surveys, sturgeon egg and larval studies, Chinook salmon and steelhead spawning surveys, and additional snorkel and RST surveys.

The principle conclusions from the information represented in the fish distribution maps will be developed by the deliverables in other study plans and tasks that the fish distribution maps were designed to support. Although the fish distribution maps will continue to evolve and be refined by additional information, there currently is a wide range of quality, quantity, consistency, and availability of information describing distribution of various fish species. If fish distribution information does not coincide with the same species suitable habitat distribution (e.g., different geographic extents), the interpretation and use of the information should be tempered and evaluated on the basis of the limitations of the source data sets. The fish distribution maps fulfill the requirements identified in Task 1 of SP-F3.2 and Task 2 of SP-F21, as well as associated plans that will draw upon this fish distribution information.

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8.0 LIST OF PREPARERS

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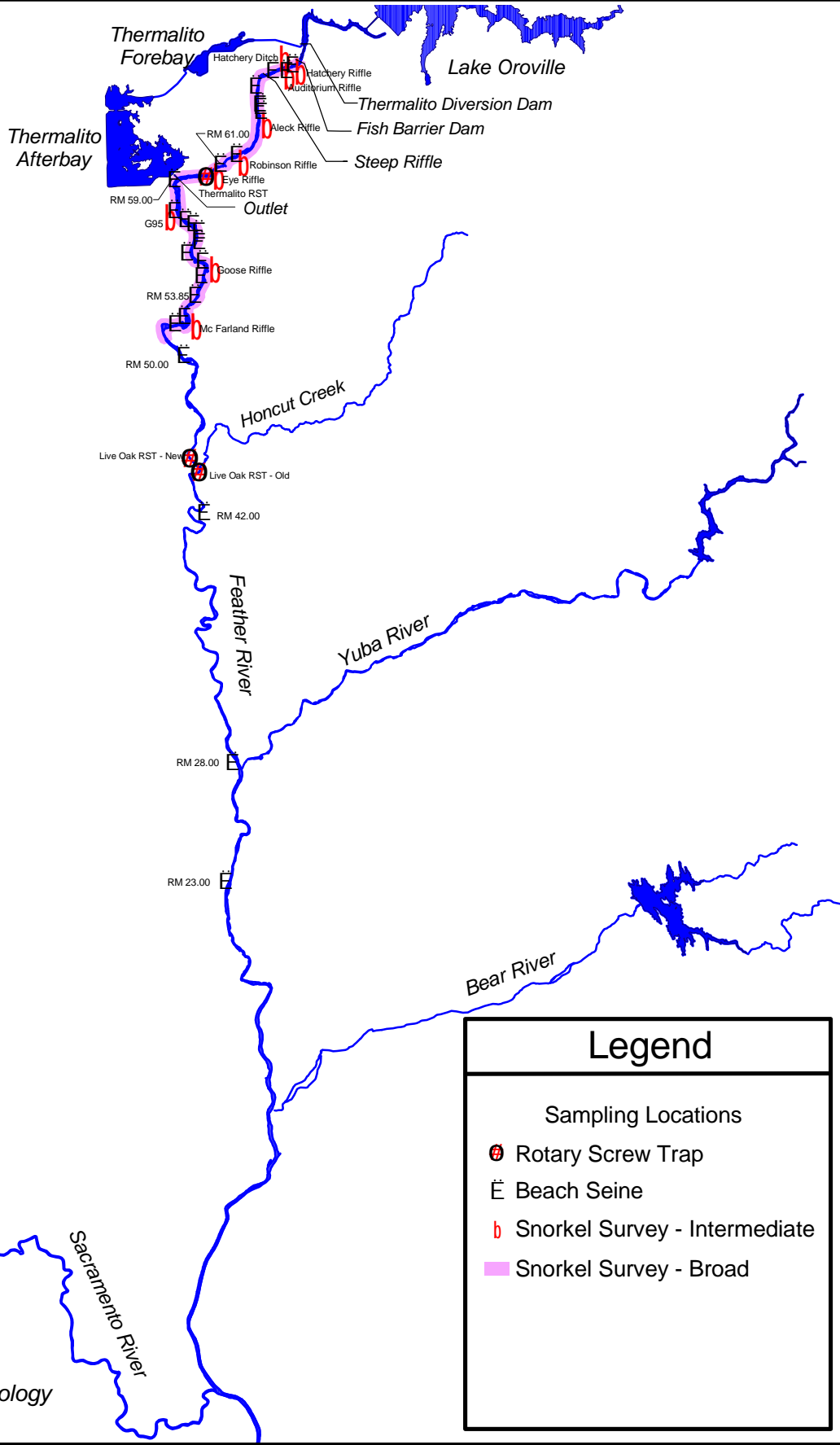
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Brad Cavallo, Environmental Scientist, DWR - data source and reviewer

Eric See, Staff Environmental Scientist, DWR - data source and reviewer

Seining Sites by River Mile:

- 66.70
- 66.50
- 66.00
- 65.00
- 64.40
- 64.30
- 64.10
- 62.00
- 61.00
- 59.00
- 57.85
- 57.40
- 57.00
- 56.60
- 56.30
- 55.70
- 55.20
- 54.65
- 53.85
- 52.75
- 51.90
- 50.00
- 42.00
- 28.00
- 23.00



Legend	
Sampling Locations	
	Rotary Screw Trap
	Beach Seine
	Snorkel Survey - Intermediate
	Snorkel Survey - Broad

Source: USGS 1:100,000 scale hydrology (SWRI modified)

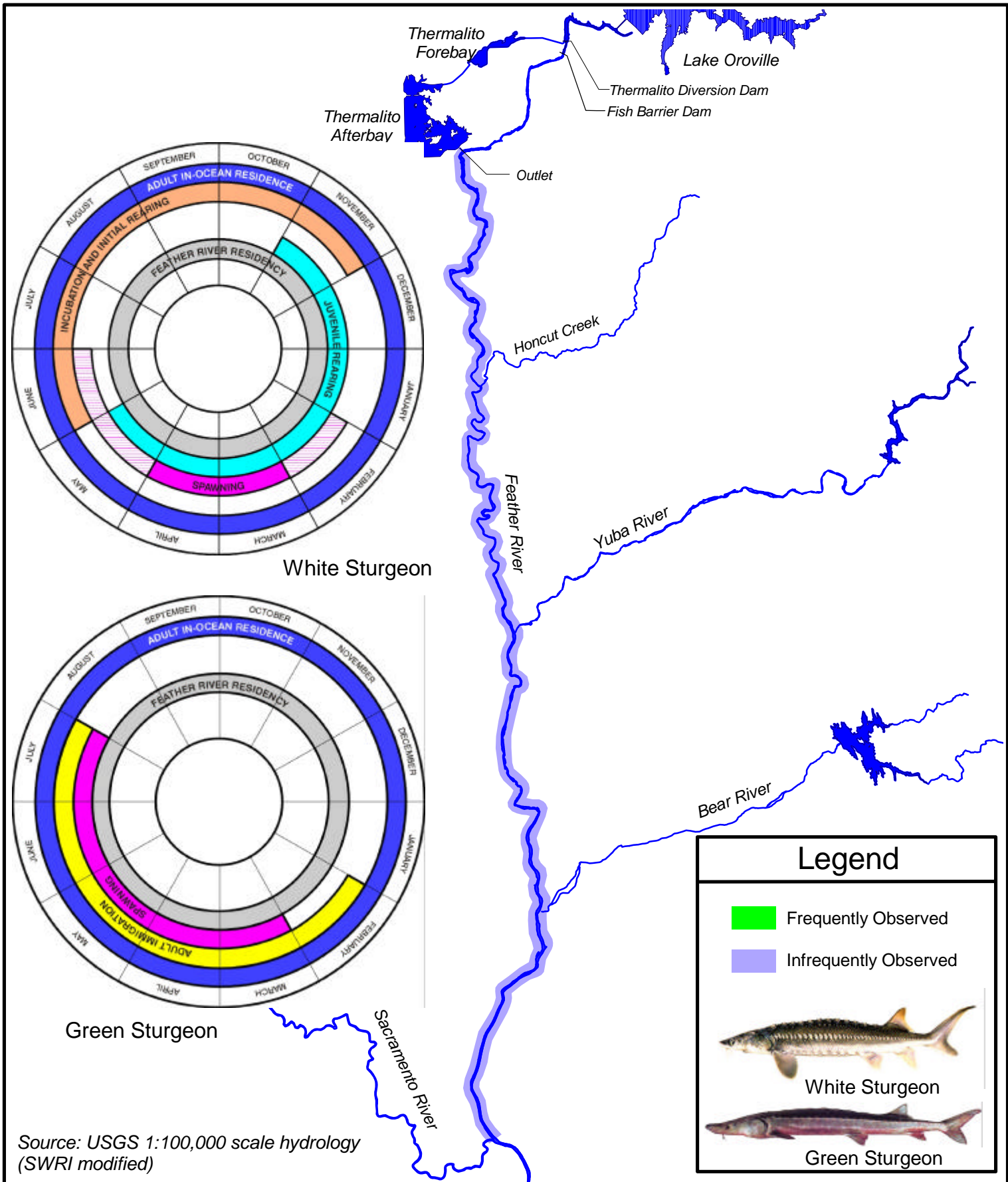


3 0 3 Miles

**Oroville FERC Relicensing
(Project No. 2100)**

Map # 1
SP-F3.2 Task 1
SP-F21 Task 2

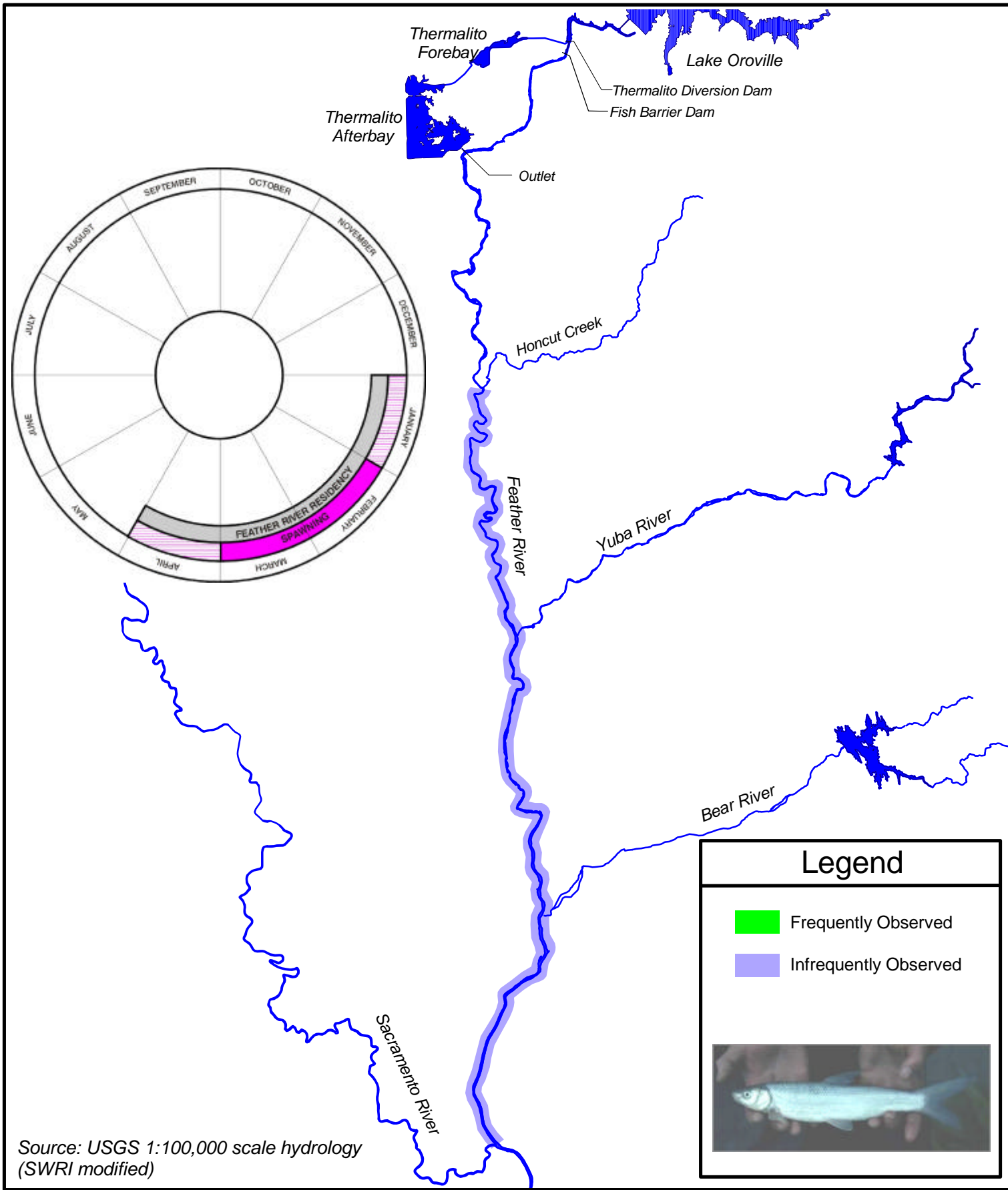
Feather River Fish Distribution - Data Source Locations






**Oroville FERC Relicensing
(Project No. 2100)**


Map # 2
SP-F3.2 Task 1

Feather River Fish Distribution: White Sturgeon (*Acipenser transmontanus*)
Green Sturgeon (*Acipenser medirostris*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)

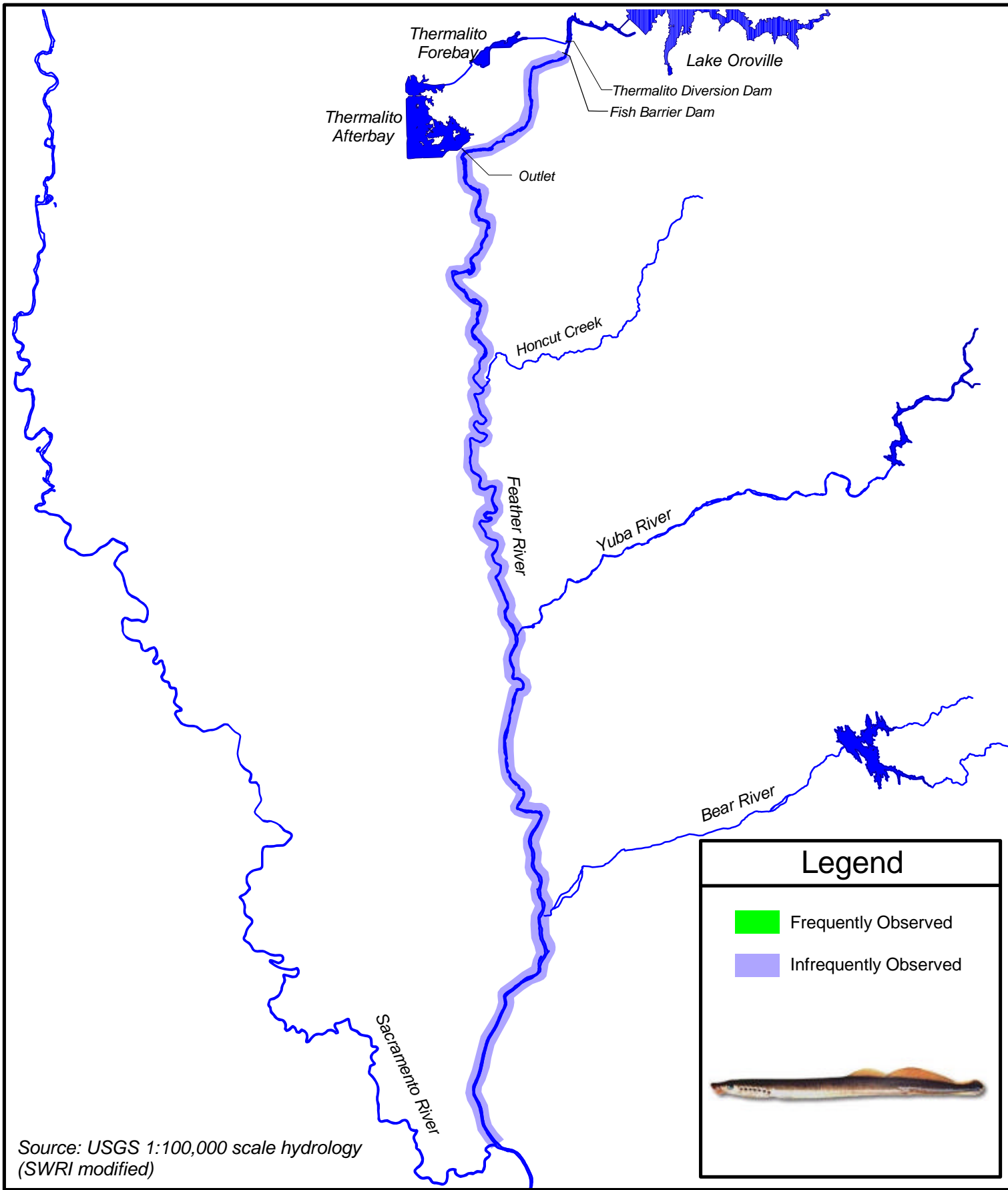
Legend	
	Frequently Observed
	Infrequently Observed
	







**Oroville FERC Relicensing
(Project No. 2100)**

Map # 3
SP-F3.2 Task 1

Feather River Fish Distribution: Sacramento Splittail
(*Pogonichthys macrolepidotus*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)

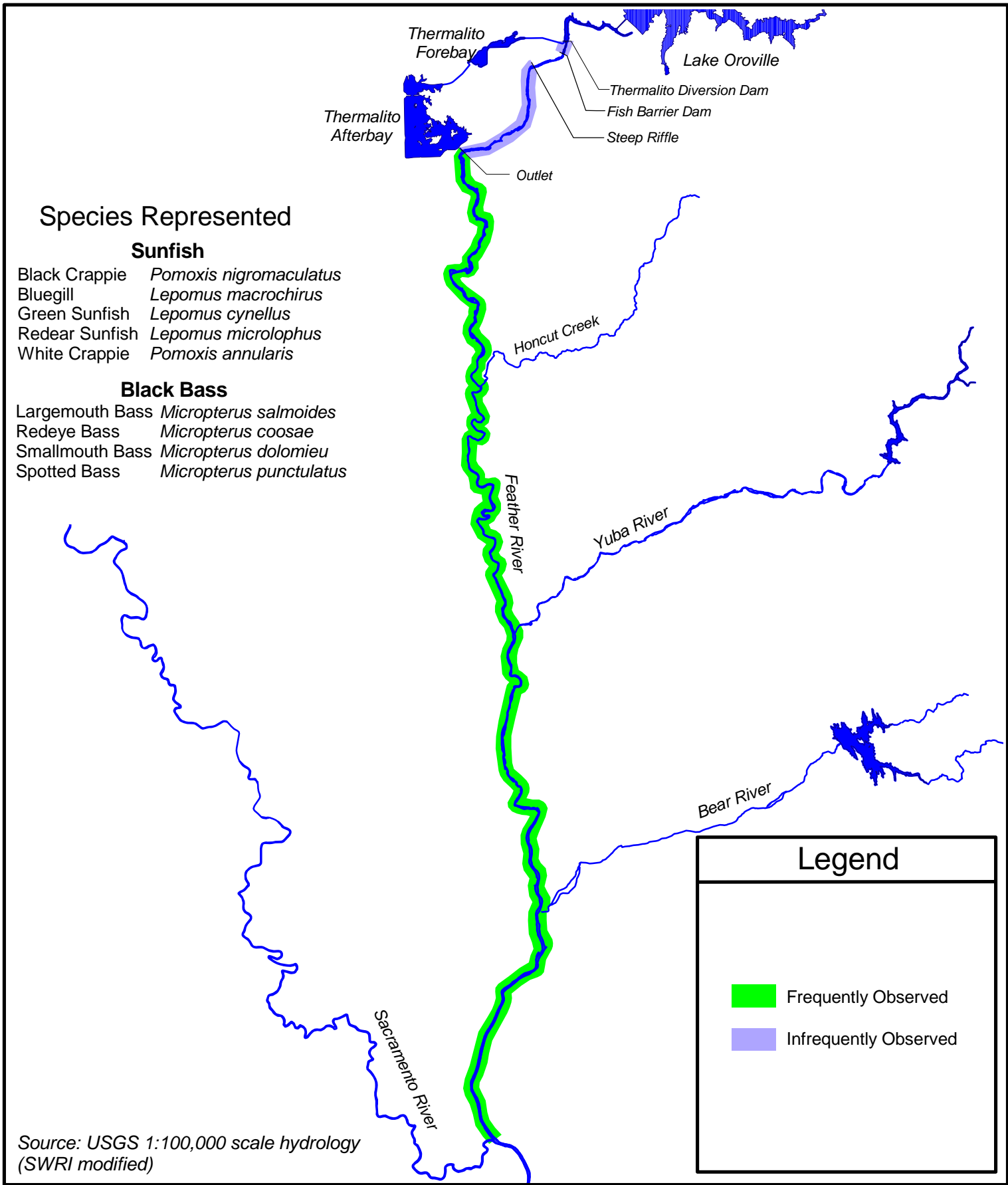
Legend	
	Frequently Observed
	Infrequently Observed
	

 N	 3 0 3 Miles
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(Project No. 2100)**

Map # 4
SP-F3.2 Task 1

Feather River Fish Distribution:	River Lamprey (<i>Lampetra ayresi</i>)
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Species Represented

Sunfish

- Black Crappie *Pomoxis nigromaculatus*
- Bluegill *Lepomis macrochirus*
- Green Sunfish *Lepomis cynellus*
- Redear Sunfish *Lepomis microlophus*
- White Crappie *Pomoxis annularis*

Black Bass

- Largemouth Bass *Micropterus salmoides*
- Redeye Bass *Micropterus coosae*
- Smallmouth Bass *Micropterus dolomieu*
- Spotted Bass *Micropterus punctulatus*

Legend	
	Frequently Observed
	Infrequently Observed

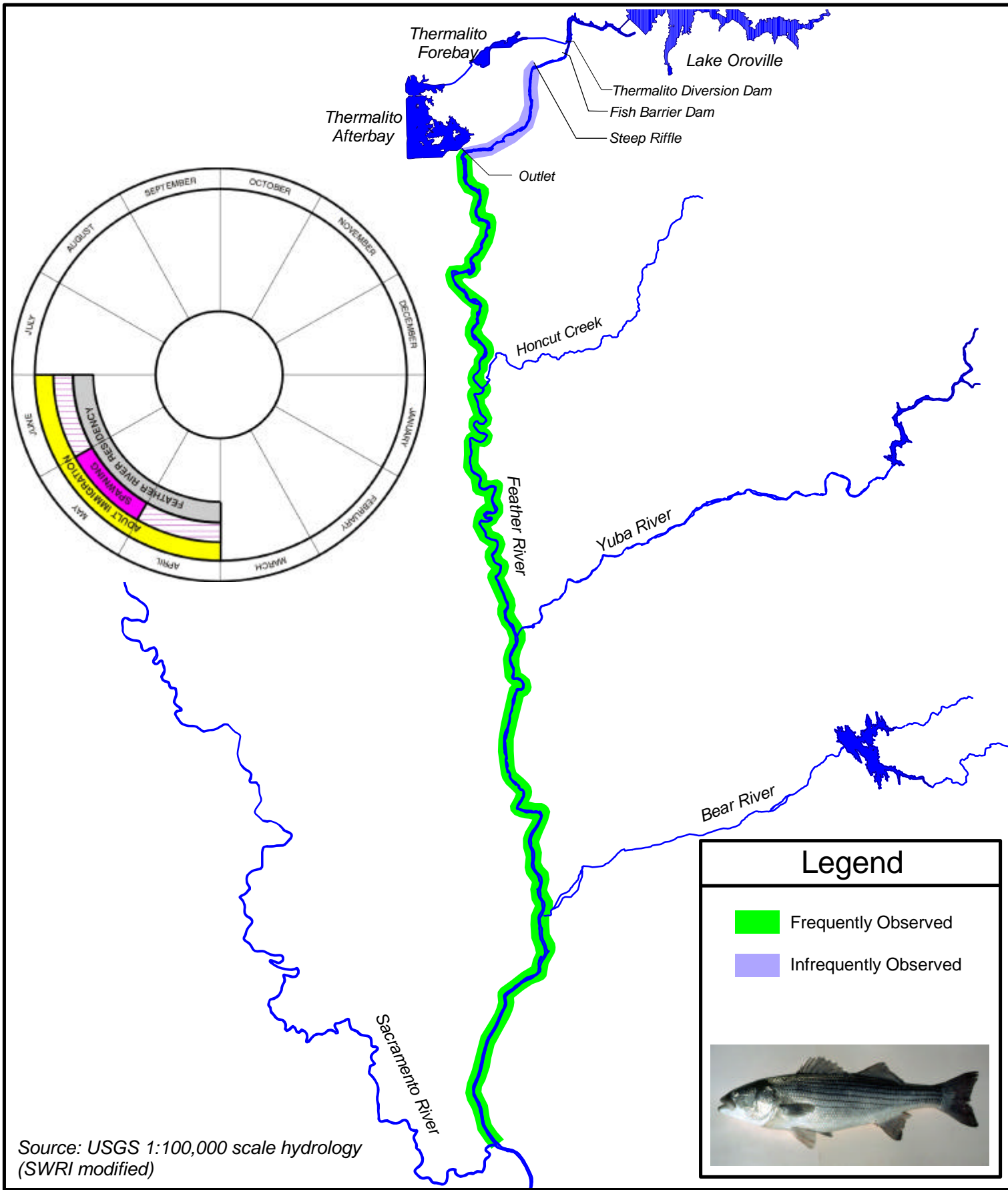
Source: USGS 1:100,000 scale hydrology (SWRI modified)

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**Oroville FERC Relicensing
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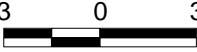
Map # 5
SP-F3.2 Task 1
SP-F21 Task 2

Feather River Fish Distribution: Centrarchids



Source: USGS 1:100,000 scale hydrology (SWRI modified)

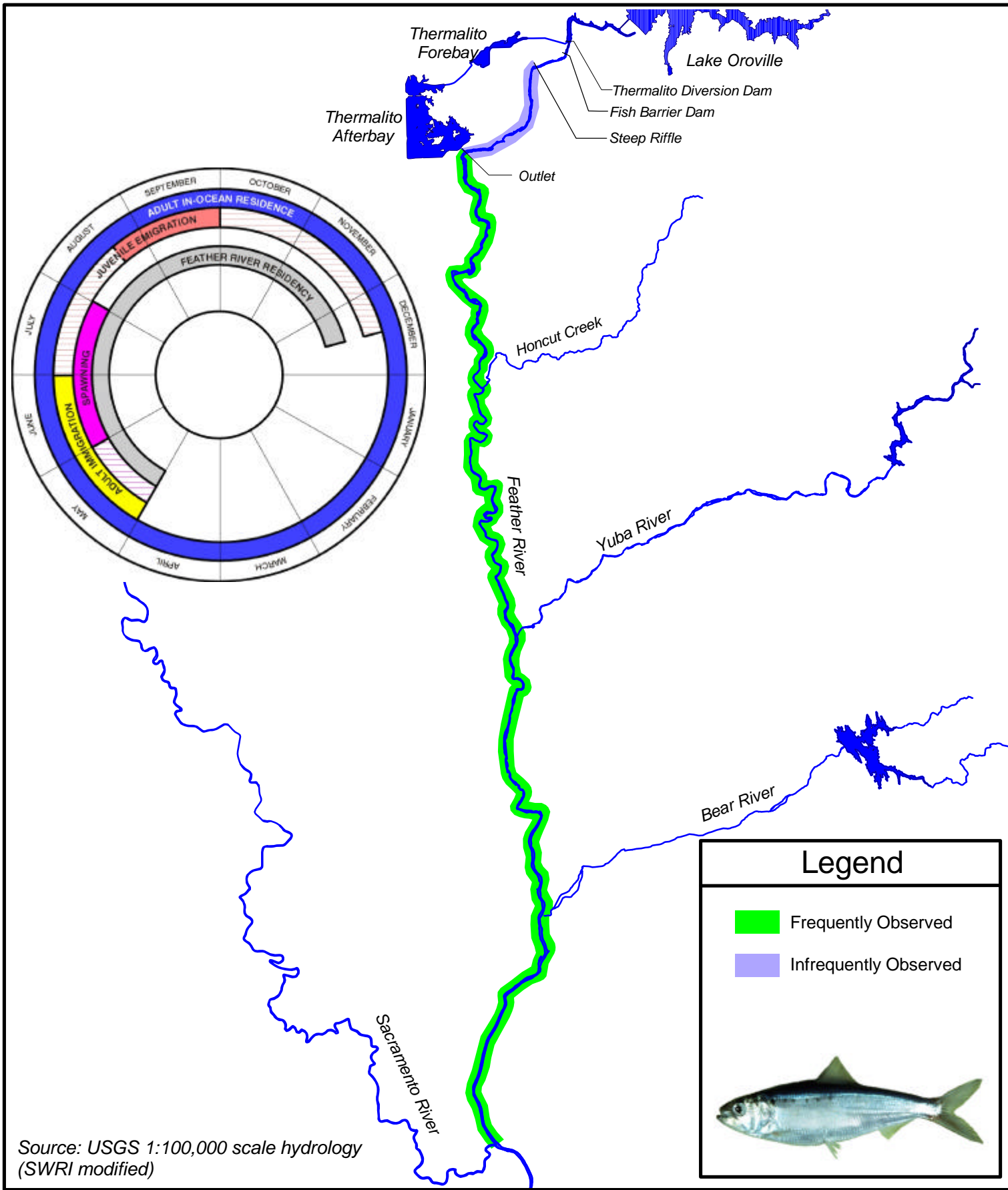
Legend	
	Frequently Observed
	Infrequently Observed
	

Oroville FERC Relicensing (Project No. 2100)

Map # 6
 SP-F3.2 Task 1
 SP-F21 Task 2

Feather River Fish Distribution: **Striped Bass (*Morone saxatilis*)**



Source: USGS 1:100,000 scale hydrology (SWRI modified)



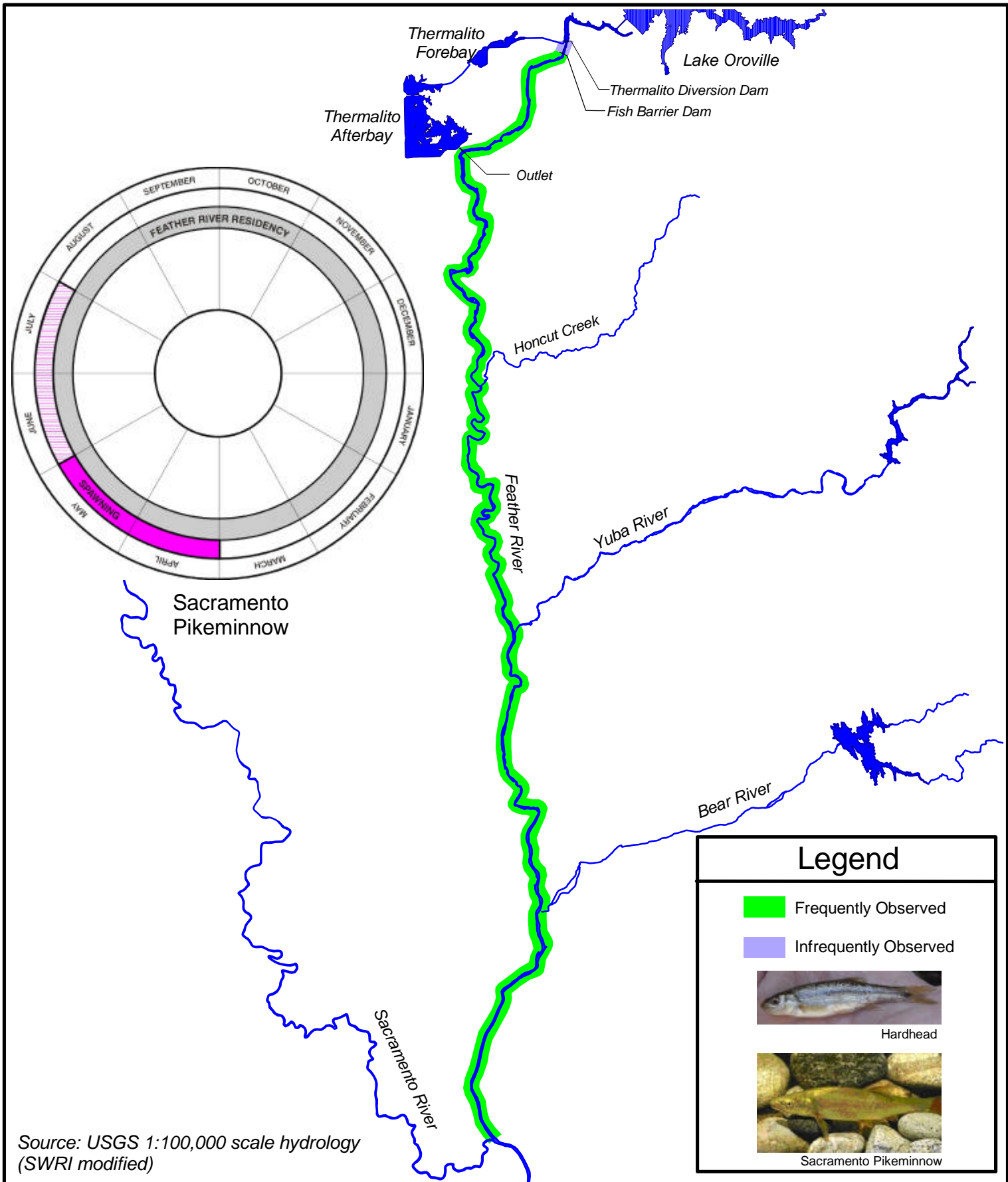
3 0 3 Miles

**Oroville FERC Relicensing
(Project No. 2100)**





Map # 7
SP-F3.2 Task 1

Feather River Fish Distribution:

American Shad
(*Alosa sapidissima*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)

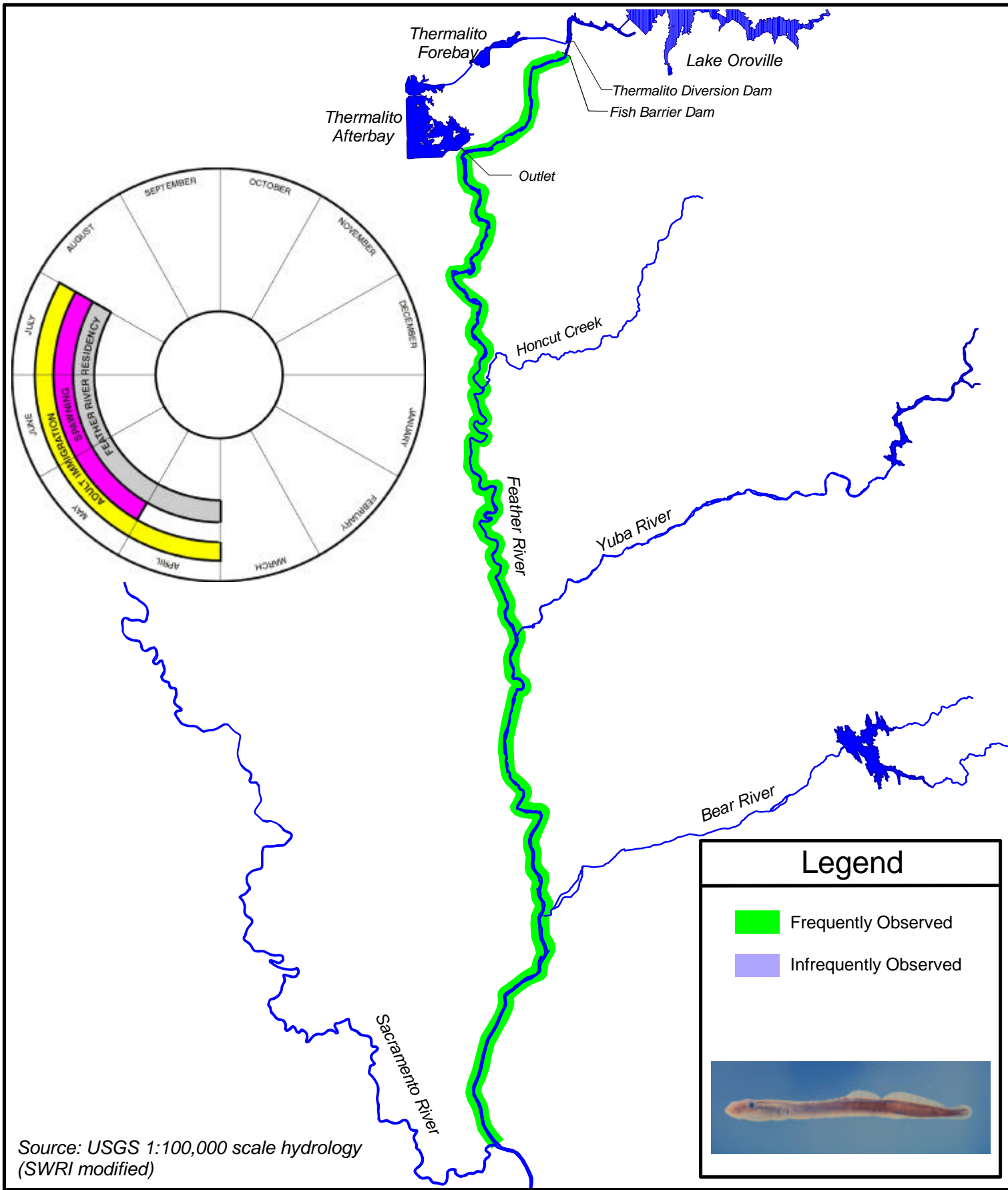
Legend	
	Frequently Observed
	Infrequently Observed
	Hardhead
	Sacramento Pikeminnow




**Oroville FERC Relicensing
(Project No. 2100)**

Map # 8
SP-F3.2 Task 1
SP-F21 Task 2

Feather River Fish Distribution: *Hardhead (Mylopharodon conocephalus)*
Sacramento Pikeminnow (Ptychocheilus grandis)



Source: USGS 1:100,000 scale hydrology (SWRI modified)



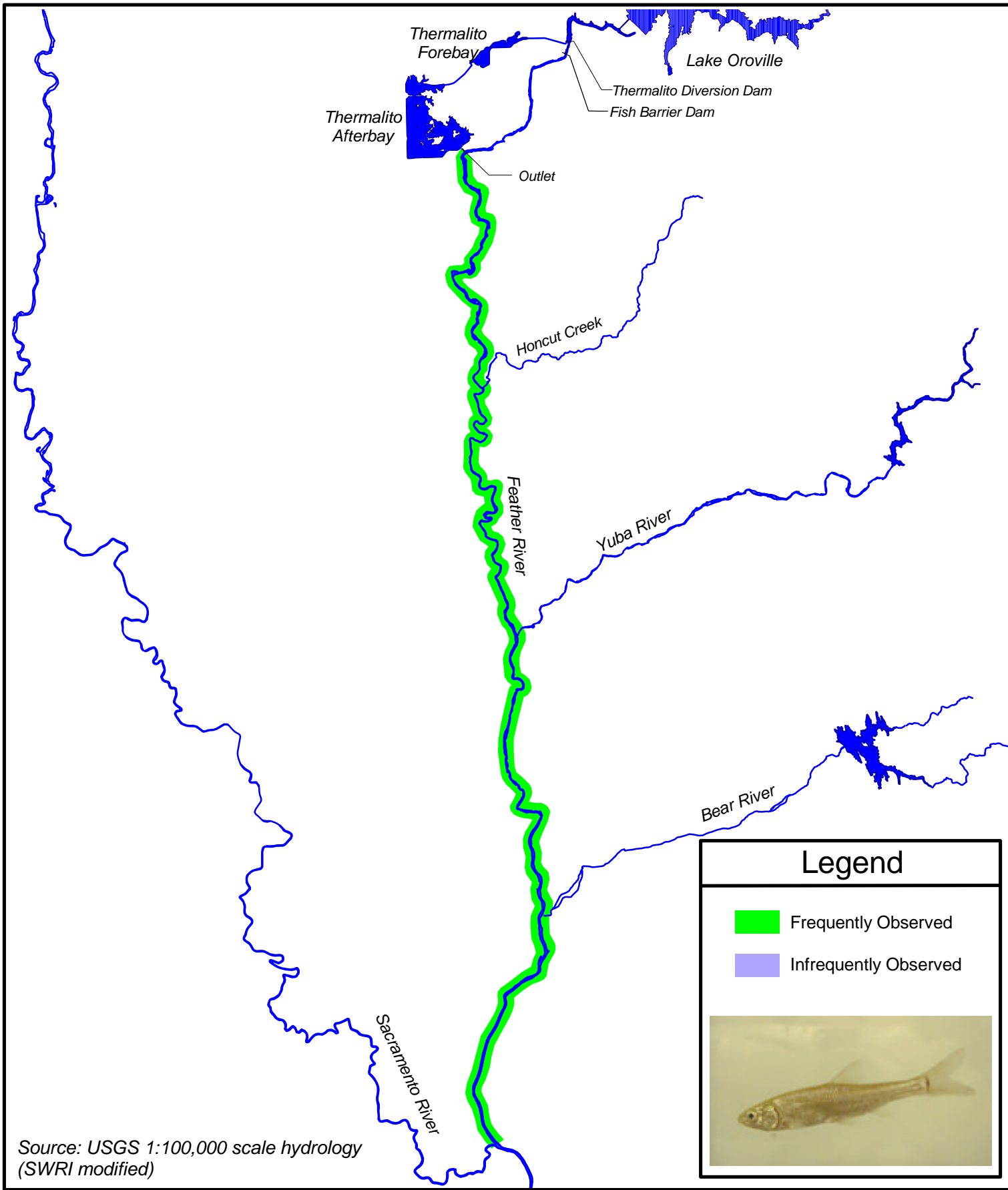
3 0 3 Miles

Oroville FERC Relicensing (Project No. 2100)




Map # 9
SP-F3.2 Task 1

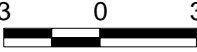
Feather River Fish Distribution:

Pacific Lamprey
(*Lampetra tridentata*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)

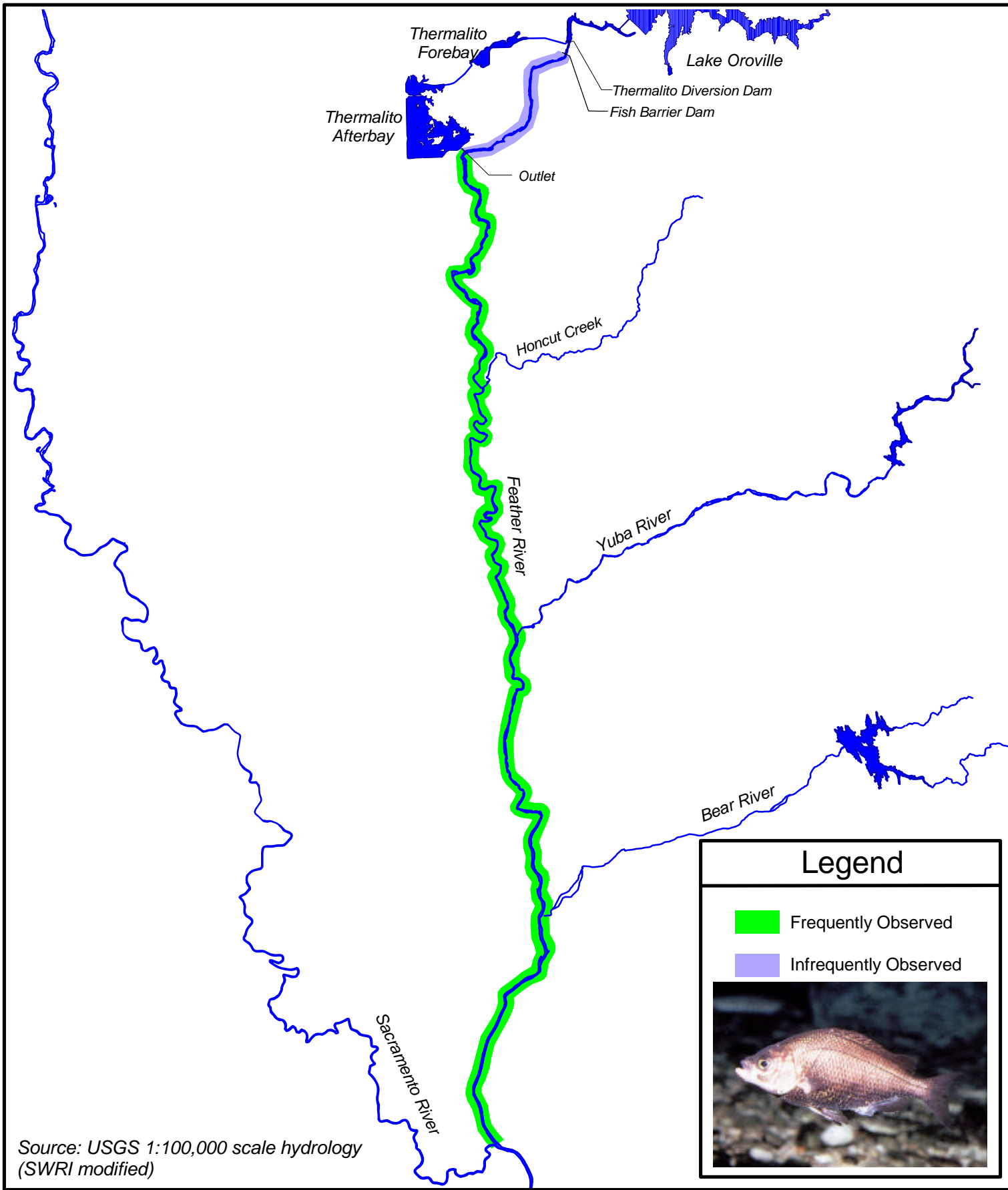
Legend	
	Frequently Observed
	Infrequently Observed
	

 N	 3 0 3 Miles
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**Oroville FERC Relicensing
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Map # 10
SP-F3.2 Task 1

Feather River Fish Distribution:	Hitch (<i>Lavinia exilicauda</i>)
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Source: USGS 1:100,000 scale hydrology (SWRI modified)

Legend	
	Frequently Observed
	Infrequently Observed
	



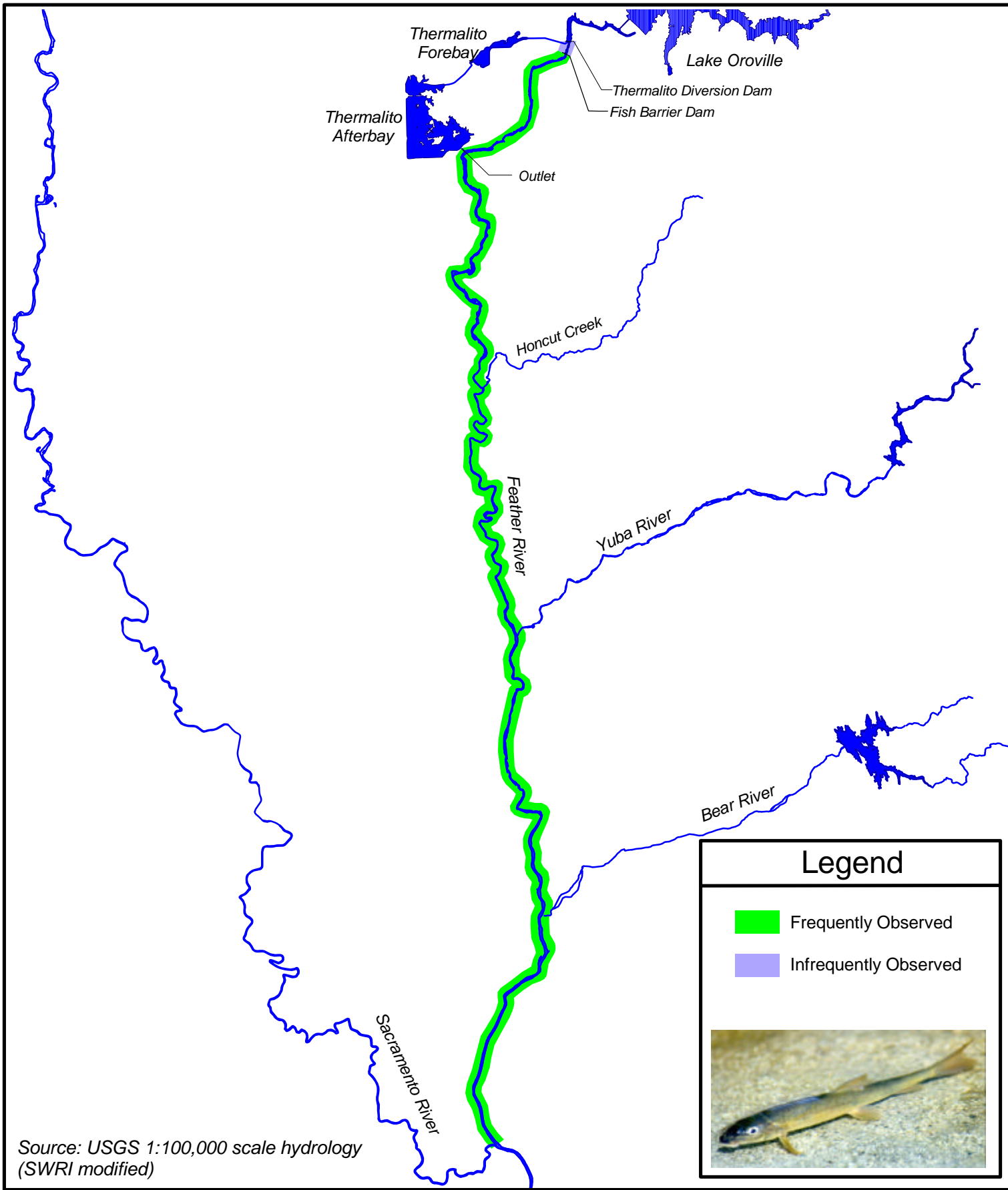
 3 0 3 Miles

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(Project No. 2100)**

Map # 11
SP-F3.2 Task 1

Feather River Fish Distribution:

**Tule Perch
(*Hysteroecarpus traskii*)**

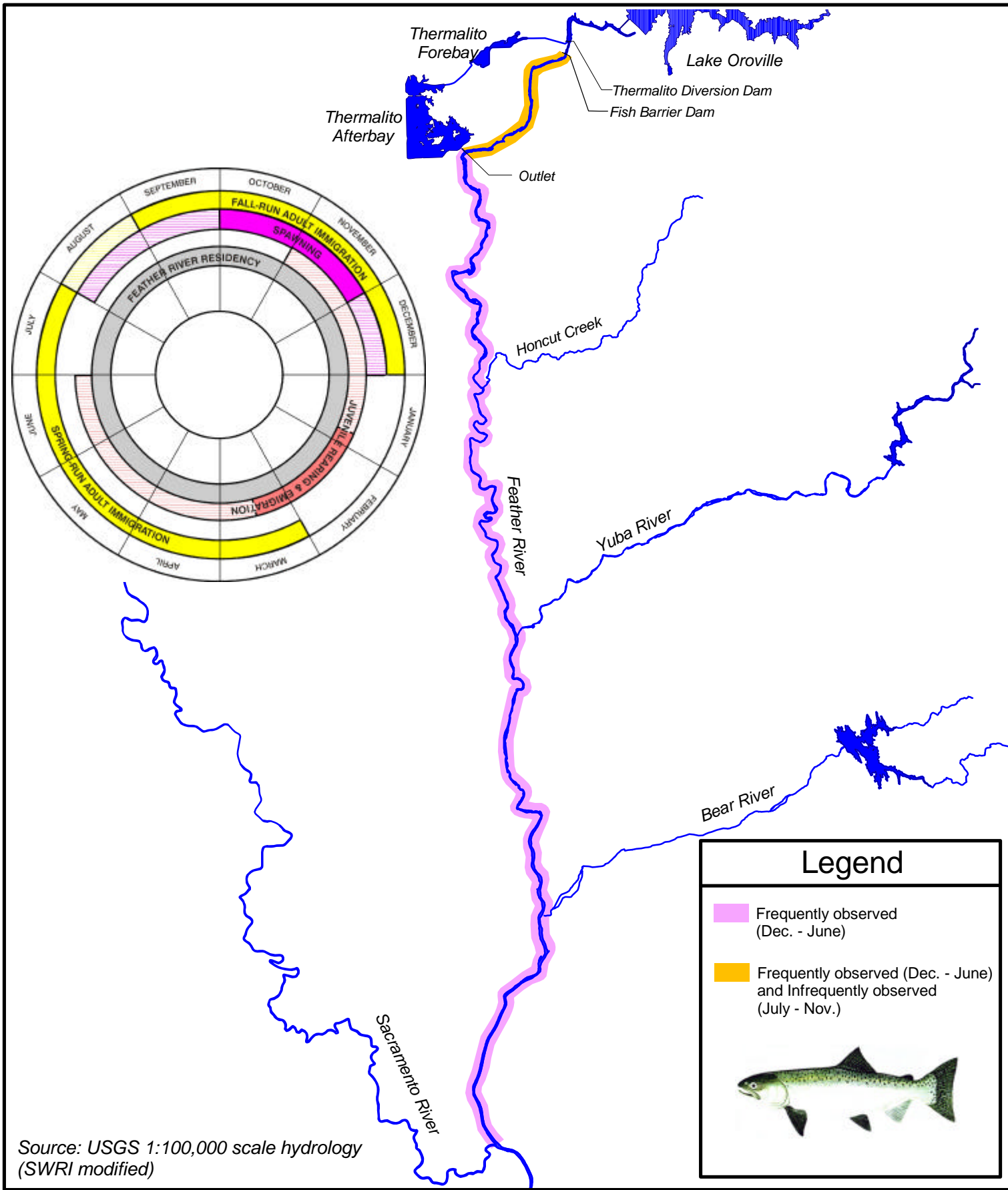


**Oroville FERC Relicensing
(Project No. 2100)**

Map # 12
SP-F3.2 Task 1

Feather River Fish Distribution:

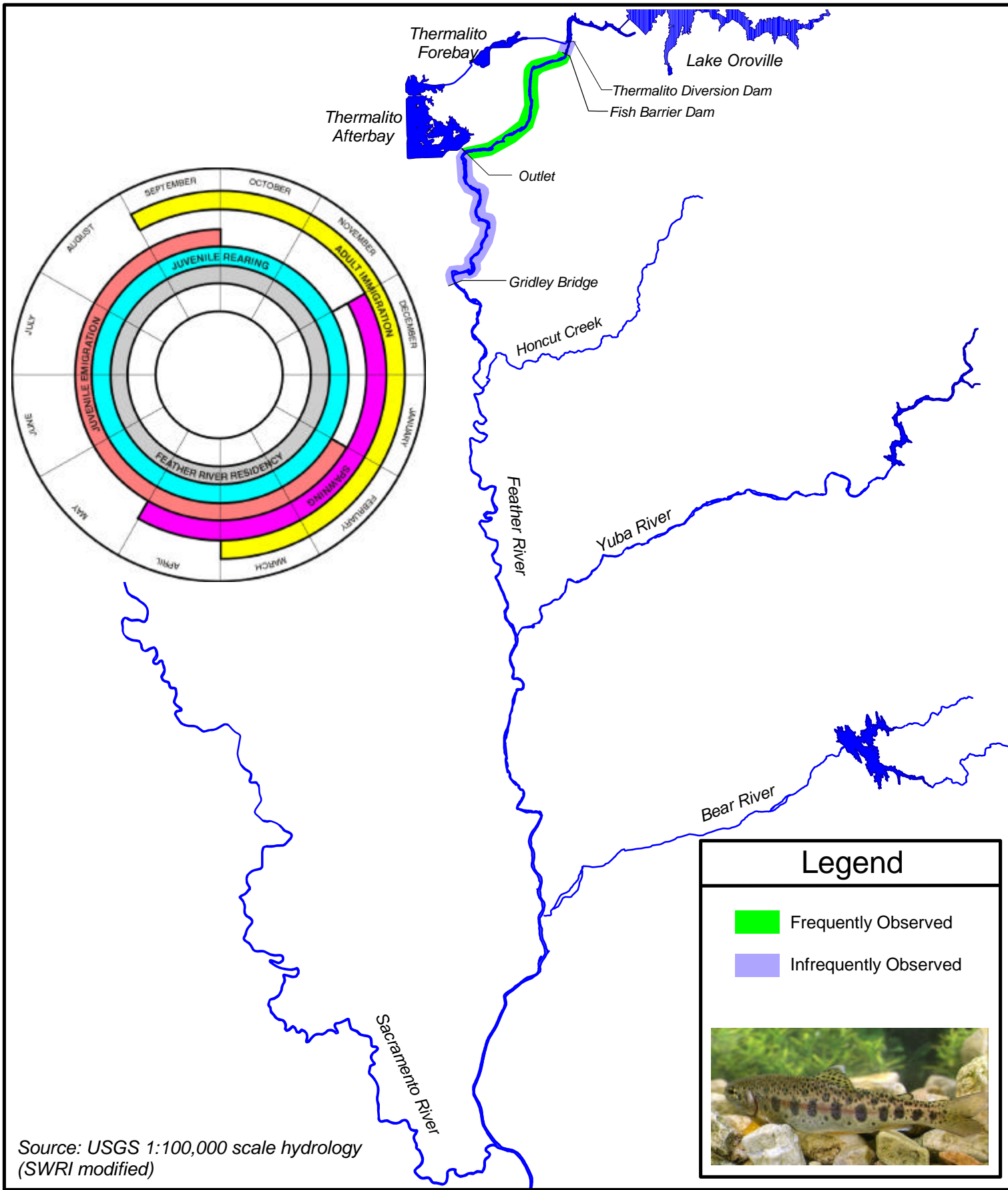
Sacramento Sucker
(*Catostomus occidentalis*)



**Oroville FERC Relicensing
(Project No. 2100)**

Map # 13
SP-F21 Task 2

Feather River Fish Distribution: Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)



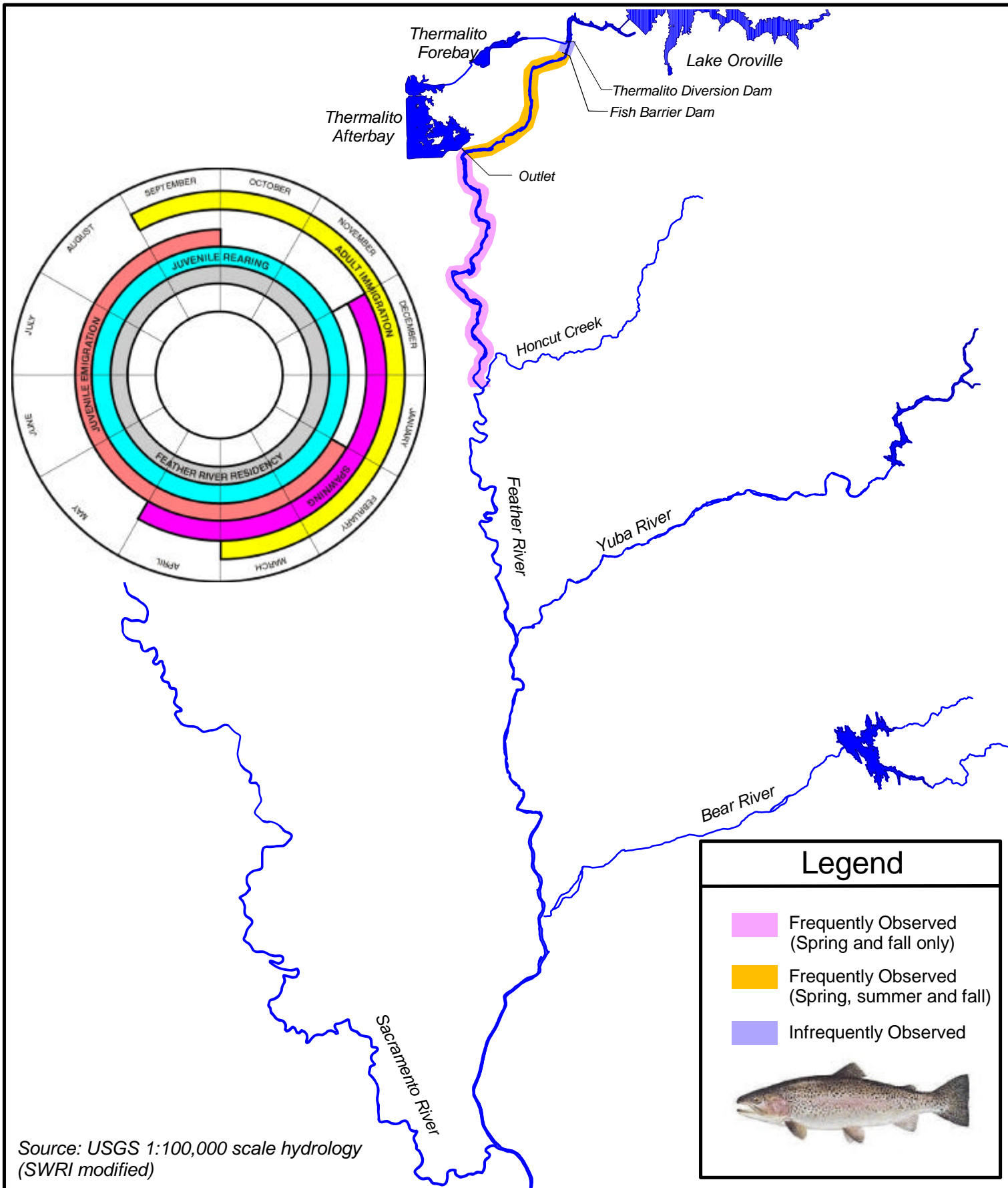
3 0 3 Miles

**Oroville FERC Relicensing
(Project No. 2100)**

Map # 14
SP-F21 Task 2

Feather River Fish Distribution:

Juvenile Rainbow Trout/Steelhead
(*Oncorhynchus mykiss*)



Source: USGS 1:100,000 scale hydrology (SWRI modified)



3 0 3 Miles

**Oroville FERC Relicensing
(Project No. 2100)**

Map # 15
SP-F21 Task 2

Feather River Fish Distribution:

Adult Rainbow Trout/Steelhead
(*Oncorhynchus mykiss*)